**5-3**

**6.**

A polynomial of degree *n* in one variable *x* is an expression of the form

*an xn* + *an*–1*xn* – 1 + *…* + *a*2 *x*2 + *a*1*x* + *a*0,

*where the coefficients an*–1*, an*–2*, an*–3*, …, a*0 *represent real numbers, an is not zero,*

*and n represents a nonnegative integer.*

A polynomial function of degree *n* can be described by an equation of the form

*P*(*x* ) = *anxn* + *an*–1*xn*–1+ … + *a*2*x*2+ *a*1 *x* + *a*0,

where the coefficients *an*–1, *an*–2, *an*–3, …, *a*0represent real numbers, *an* is not zero,

and *n* represents a nonnegative integer.

**Lesson 5-3**

**Polynomial Functions**

**Study Guide and Intervention**

***Polynomial Functions***

**Polynomial in**

**One Variable**

**Polynomial**

**Function**

*Glencoe Algebra 2*

Chapter 5

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**9.** *f* (*x*) = 9*x*3 – 4*x*2 + 5*x* + 7

**8.** *f* (*x*) = 4*x*3 – 3*x*2 + 2*x* – 1

**7.** *f* (*x*) = *x*2 – 9

**Find *f*(2) and *f*(–5) for each function.**

**5.** 8*x*3 – 9*x*5 + 4*x*2 – 36

**4.** 4*x*2 – 3*xy* + 16*y*2

**3.** 4*x*6 + 6*x*4 + 8*x*8 – 10*x*2 + 20

**2.** 100 – 5*x*3 + 10*x*7

**1.** 3*x*4 + 6*x*3 – *x*2 + 12

**State the degree and leading coefficient of each polynomial in one variable. If it is**

**not a polynomial in one variable, explain why.**

Original function

Replace x with a2 – 1. Evaluate.

Simplify.

*g*(*x*) = *x*2 + 3*x* – 4

*g*(*a*2 – 1) = (*a*2 – 1)2 + 3(*a*2 – 1) – 4

= *a*4 – 2*a*2 + 1 + 3*a*2 – 3 – 4

= *a*4 + *a*2 – 6

**Exercises**

**Find *g*(*a*2 – 1) if *g*(*x*) = *x*2 + 3*x* – 4.**

**Example 3**

Original function

Replace x with –5. Evaluate.

Simplify.

*f* (*x*) = *x*3 + 2*x*2 – 10*x* + 20

*f* (–5) = (–5)3 + 2(–5)2 – 10(–5) + 20

= –125 + 50 + 50 + 20

= –5

**Find *f*(–5) if *f* (*x*) = *x*3 + 2*x*2 – 10*x* + 20.**

**Example 2**

Rewrite the expression so the powers of *x* are in decreasing order.

–2*x*4 + *x*3 + 3*x*2 – 7

This is a polynomial in one variable. The degree is 4, and the leading coefficient is –2.

**What are the degree and leading coefficient of 3*x*2 – 2*x*4 – 7 + *x*3?**

**Example 1**

The **degree of a polynomial** in one variable is the greatest exponent of its variable. The **leading coefficient** is the coefficient of the term with the highest degree.

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Chapter 5

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***f* (*x*)**

As *x* → –∞, *f* (*x*) → –∞ and as *x* → +∞, *f*(*x*) → +∞, so it is an odd-degree polynomial function.   
The graph intersects the *x*-axis at 1 point,   
so the function has 1 real zero.

***f* (*x*)**

***f* (*x*)**

***f* (*x*)**

**Graphs of Polynomial Functions**

**5-3**

**Study Guide and Intervention** *(continued)*

***Polynomial Functions***

**Exercises**

**For each graph,**

**a. describe the end behavior,**

**b. determine whether it represents an odd-degree or an even-degree function, and c. state the number of real zeroes.**

The ma*x*imum number of zeros of a polynomial function is equal to the degree of the polynomial. On a graph, count the number of real zeros of the function by counting the number of times the

**Real Zeros of a Polynomial Function**

If the degree is even and the leading coefficient is positive, then

*f*(*x*) → +∞ as *x* → –∞ *f*(*x*) → +∞ as *x* → +∞

If the degree is even and the leading coefficient is negative, then

*f*(*x*) → –∞ as *x* → –∞ *f*(*x*) → –∞ as *x* → +∞

If the degree is odd and the leading coefficient is positive, then

*f*(*x*) → –∞ as *x* → –∞ *f*(*x*) → +∞ as *x* → +∞

If the degree is odd and the leading coefficient is negative, then

*f*(*x*) → +∞ as *x* → –∞ *f*(*x*) → –∞ as *x* → +∞

**End Behavior of Polynomial Functions**

***O***

–

***O***

***O***

***O***

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**18**

–4

–4

–4

–2

–2

–2

4 ***x***

2

–2

–4

4 ***x***

2

–2

–4

4 ***x***

2

–2

–4

2

2

2

4

4

4

**3.**

**2.**

**1.**

–4

–2

4 ***x***

2

–2

–4

2

**or an even-degree polynomial. Then state the number of real zeros.**

**Determine whether the graph represents an odd-degree polynomial**

**Example**

graph crosses or touches the *x*-a*x*is.

A zero of a function is a point at which the graph intersects the *x*-a*x*is.

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